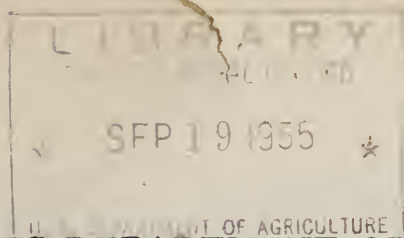


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STANDARDIZING DAIRY-HERD-IMPROVEMENT-ASSOCIATION
RECORDS IN PROVING SIRES

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INTRODUCTION

In proving dairy sires, by comparing the production records of the daughters of a sire with those of their dams, production records usually are adjusted or standardized to some extent to make them as nearly comparable as possible. All production records should be on a comparable basis so the proved-sire records will indicate the relative breeding value of the different sires.

It is recognized that production records of dairy cows are influenced by many variable factors such as age, live weight, number of times milked daily, length of lactation period, gestation, environment (feeding level, housing, care, etc.), and length of dry period before freshening. Numerous studies by various investigators have shown repeatedly that these and other factors have a definite influence on the amount of milk and butterfat produced by a cow. Investigations have shown also that, although it is not possible, at least at present, to adjust production records for all factors that affect production, it is practicable to adjust them for (1) length of lactation period, (2) number of milkings per day, and (3) age.

In the Nationwide Dairy-Herd-Improvement Association Sire-Proving Program, all records used for proving sires are adjusted for these three factors as described below.

Length of Lactation Period

In 1935, the American Dairy Science Association adopted the 305-day lactation record for use in proving sires used in dairy-herd-improvement associations. The States now report to the Dairy Husbandry Research Branch the production record of a cow for the first 305 days of her lactation period. Use of production records for only the first 305 days

of the lactation period reduces materially the effect of variation in , length of lactation period. It also reduces to a considerable extent the variation in records resulting from the influence of gestation. Furthermore, it most closely represents the length of time the farmer milks cows between calvings.

Number of Milkings Per Day

Records of cows milked 3 or 4 times daily are reduced to a twice-a-day milking basis.

Through the years various investigators have made numerous studies to determine the effect of frequency of milking on total milk production. While the results of these studies are not in complete agreement, there is sufficient evidence to indicate that, on the average, at 2 years of age a cow will produce approximately 20 percent more milk if she is milked 3 times a day than if she is milked only twice a day; at 3 years of age she will produce approximately 17 percent more; and at 4 years of age and over, she will produce approximately 15 percent more. Similarly, at 2 years of age a cow will produce approximately 35 percent more milk if she is milked 4 times a day than if she is milked only twice a day; at 3 years of age, she will produce approximately 30 percent more; and at 4 years of age and over, she will produce approximately 26 percent more.

In proving DHIA sires, these percentages are used as a basis for adjusting production records of cows milked more than twice a day to a twice-a-day milking basis. The procedure is outlined on pages 12, 13, and 14.

Age-Conversion Factors

To correct production records used in the sire-proving program for variation caused by differences in age. the records are converted to a mature-equivalent basis. When the Nationwide proved-sire program was inaugurated in 1935, the Dairy Husbandry Research Branch developed a set of "all-breed" age-conversion factors, based on a study of the DHIA production records that were available at that time. However, these factors were not entirely satisfactory, as they did not allow for the different rates at which cows of different breeds mature and reach their production peak.

By 1941, enough production records had accumulated so that age-conversion factors could be developed to take care of some differences between breeds. One set of factors was developed for the Ayrshire, Jersey, and Guernsey breeds; one for the Brown Swiss and Milking Shorthorn breeds; and one for the Holstein breed. The factors were combined to provide a set of factors for converting records of cows of mixed breeding.

These breed factors were an improvement over the all-breed factors, but it was recognized that when enough data had accumulated in the Branch's files to permit a more comprehensive study of the relationship between age and production by breeds, it would be possible to develop still more reliable factors.

The new age-conversion factors are based on a study of the 72,860 DHIA 305-day lactation records of cows milked twice a day that were reported during the period 1945 through 1952, as shown in table 1. In addition, the Holstein factors are based also on a similar study made by the Holstein-Friesian Association of 211,678 Herd Test records. The results of the two studies, which were made simultaneously and independently, were practically identical, and it was decided to combine the two studies, thus providing one set of Holstein age-conversion factors based on DHIA and Holstein Herd Test records.

Table 1. -Number of records used in study of age-production relationship,
by breeds

| <u>Breed</u> | <u>Records</u> <u>(number)</u> |
|---|-----------------------------------|
| Ayrshire----- | 32,674 |
| Brown Swiss----- | 26,902 |
| Guernsey----- | 141,943 |
| Holstein (72,860 DHIA) (211,678 Herd Test)--- | 284,538 |
| Jersey----- | 94,316 |
| Shorthorn----- | 8,489 |

The age-conversion factors for each breed were developed according to the following procedure:

- (1) All 305-day DHIA lactation records of cows milked twice daily reported since about 1945 were included in this study.
- (2) The records were sorted by monthly age groups.
- (3) The records for each age group were totaled and averaged.
- (4) The average production for each age group was graphed, to determine the age at which each breed reaches the maximum level of production.
- (5) The relationship between the average production of each age group and the maximum level of production was calculated.

- (6) Age-production curves for each breed were developed from the data, the curves were smoothed, and the final age-conversion factors were calculated for each breed.

The age-conversion factors for the various breeds were combined to provide a set of factors for standardizing records of cows of mixed breeding.

The age-conversion factors which are to be used after August 1, 1954, are listed in table 2, pages 5 to 11. The breed factors are used for both grade and registered animals; the mixed breed factors are used only when the predominant breed of an animal is not distinguishable. Sufficient data were not available to develop reliable age-conversion factors for the Red Dane and Red Poll breeds. Limited studies of data for these breeds indicated that the age-production relationship for the Red Dane breed is similar to that of the Holstein and the age-production relationship of the Red Poll breed is similar to that of the Milking Shorthorn. Therefore, the Holstein and Milking Shorthorn factors will be used for standardizing the Red Dane and Red Poll records respectively. The factors are limited to two decimal places, in accordance with the recommendations of the American Dairy Science Association.

Age-conversion factors applied to the production records of a group of dams and daughters reliably indicate the average mature equivalent record for the group. It should be recognized that when the factors are applied to single records the calculated mature-equivalent record for a cow may occasionally vary considerably from her actual mature record if one is obtained.

The factors in table 2, pages 5 to 11, are used to convert to a mature-equivalent basis the 305-day records made by cows of different ages, when milked only twice daily during the lactation period, by multiplying the cow's actual production record by her age factor.

For example, to obtain the mature-equivalent record for a cow 3 years 6 months of age at the time of freshening, the actual production record is multiplied by the factor indicated for the breed in table 2, as follows: Ayrshire, 1.13 (page 5); Brown Swiss, 1.16 (page 6); Guernsey, 1.08 (page 7); Holstein, 1.12 (page 8); Jersey, 1.09 (page 9); Shorthorn, 1.18 (page 10); and cows of mixed breeding, 1.12 (page 11).

To standardize records of cows milked more than twice a day during all or any portion of the lactation period, the factors in table 2 are used to determine the mature-equivalent record. The mature-equivalent record is then reduced to a twice-a-day milking basis as described on page 12.

Table 2. -New age-conversion factors for 305-day production records

AYRSHIRE

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|--------|--------|---------|--------|
| 1 - 9 | 1.36 | 5 - 3 | 1.02 | 10 - 6 | 1.03 |
| 1 - 10 | 1.34 | 5 - 4 | 1.02 | 10 - 7 | 1.03 |
| 1 - 11 | 1.32 | 5 - 5 | 1.02 | 10 - 8 | 1.03 |
| 2 - 0 | 1.30 | 5 - 6 | 1.02 | 10 - 9 | 1.03 |
| 2 - 1 | 1.29 | 5 - 7 | 1.01 | 10 - 10 | 1.03 |
| 2 - 2 | 1.28 | 5 - 8 | 1.01 | 10 - 11 | 1.03 |
| 2 - 3 | 1.27 | 5 - 9 | 1.01 | 11 - 0 | 1.04 |
| 2 - 4 | 1.26 | 5 - 10 | 1.01 | 11 - 1 | 1.04 |
| 2 - 5 | 1.25 | 5 - 11 | 1.01 | 11 - 2 | 1.04 |
| 2 - 6 | 1.24 | 6 - 0 | | 11 - 3 | 1.04 |
| 2 - 7 | 1.23 | to | | 11 - 4 | 1.04 |
| 2 - 8 | 1.22 | 7 - 11 | 1.00 | 11 - 5 | 1.04 |
| 2 - 9 | 1.21 | 8 - 0 | 1.00 | 11 - 6 | 1.05 |
| 2 - 10 | 1.20 | 8 - 1 | 1.01 | 11 - 7 | 1.05 |
| 2 - 11 | 1.19 | 8 - 2 | 1.01 | 11 - 8 | 1.05 |
| 3 - 0 | 1.18 | 8 - 3 | 1.01 | 11 - 9 | 1.05 |
| 3 - 1 | 1.17 | 8 - 4 | 1.01 | 11 - 10 | 1.05 |
| 3 - 2 | 1.16 | 8 - 5 | 1.01 | 11 - 11 | 1.05 |
| 3 - 3 | 1.15 | 8 - 6 | 1.01 | 12 - 0 | 1.06 |
| 3 - 4 | 1.14 | 8 - 7 | 1.01 | 12 - 1 | 1.06 |
| 3 - 5 | 1.14 | 8 - 8 | 1.01 | 12 - 2 | 1.06 |
| 3 - 6 | 1.13 | 8 - 9 | 1.01 | 12 - 3 | 1.06 |
| 3 - 7 | 1.13 | 8 - 10 | 1.01 | 12 - 4 | 1.06 |
| 3 - 8 | 1.12 | 8 - 11 | 1.01 | 12 - 5 | 1.06 |
| 3 - 9 | 1.12 | 9 - 0 | 1.02 | 12 - 6 | 1.07 |
| 3 - 10 | 1.11 | 9 - 1 | 1.02 | 12 - 7 | 1.07 |
| 3 - 11 | 1.11 | 9 - 2 | 1.02 | 12 - 8 | 1.07 |
| 4 - 0 | 1.10 | 9 - 3 | 1.02 | 12 - 9 | 1.07 |
| 4 - 1 | 1.10 | 9 - 4 | 1.02 | 12 - 10 | 1.07 |
| 4 - 2 | 1.09 | 9 - 5 | 1.02 | 12 - 11 | 1.07 |
| 4 - 3 | 1.08 | 9 - 6 | 1.02 | 13 - 0 | 1.07 |
| 4 - 4 | 1.08 | 9 - 7 | 1.02 | 13 - 1 | 1.07 |
| 4 - 5 | 1.07 | 9 - 8 | 1.02 | 13 - 2 | 1.07 |
| 4 - 6 | 1.06 | 9 - 9 | 1.02 | 13 - 3 | 1.08 |
| 4 - 7 | 1.06 | 9 - 10 | 1.02 | 13 - 4 | 1.08 |
| 4 - 8 | 1.05 | 9 - 11 | 1.02 | 13 - 5 | 1.08 |
| 4 - 9 | 1.05 | 10 - 0 | 1.03 | 13 - 6 | 1.08 |
| 4 - 10 | 1.04 | 10 - 1 | 1.03 | 13 - 7 | 1.08 |
| 4 - 11 | 1.04 | 10 - 2 | 1.03 | 13 - 8 | 1.08 |
| 5 - 0 | 1.03 | 10 - 3 | 1.03 | 13 - 9 | 1.08 |
| 5 - 1 | 1.03 | 10 - 4 | 1.03 | 13 - 10 | 1.08 |
| 5 - 2 | 1.02 | 10 - 5 | 1.03 | 13 - 11 | 1.08 |
| | | | | 14 - 0 | 1.09 |

Table 2. -New age-conversion factors for 305-day production records-
continued

BROWN SWISS

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|--------|--------|---------|--------|
| 1 - 9 | 1.48 | 5 - 3 | 1.03 | 10 - 6 | 1.03 |
| 1 - 10 | 1.47 | 5 - 4 | 1.03 | 10 - 7 | 1.03 |
| 1 - 11 | 1.46 | 5 - 5 | 1.02 | 10 - 8 | 1.03 |
| 2 - 0 | 1.45 | 5 - 6 | 1.02 | 10 - 9 | 1.03 |
| 2 - 1 | 1.44 | 5 - 7 | 1.02 | 10 - 10 | 1.03 |
| 2 - 2 | 1.43 | 5 - 8 | 1.01 | 10 - 11 | 1.03 |
| 2 - 3 | 1.41 | 5 - 9 | 1.01 | 11 - 0 | 1.04 |
| 2 - 4 | 1.39 | 5 - 10 | 1.01 | 11 - 1 | 1.04 |
| 2 - 5 | 1.37 | 5 - 11 | 1.01 | 11 - 2 | 1.04 |
| 2 - 6 | 1.35 | 6 - 0 | | 11 - 3 | 1.04 |
| 2 - 7 | 1.33 | to | | 11 - 4 | 1.04 |
| 2 - 8 | 1.31 | 7 - 11 | 1.00 | 11 - 5 | 1.04 |
| 2 - 9 | 1.29 | 8 - 0 | 1.00 | 11 - 6 | 1.05 |
| 2 - 10 | 1.27 | 8 - 1 | 1.01 | 11 - 7 | 1.05 |
| 2 - 11 | 1.25 | 8 - 2 | 1.01 | 11 - 8 | 1.05 |
| 3 - 0 | 1.23 | 8 - 3 | 1.01 | 11 - 9 | 1.05 |
| 3 - 1 | 1.21 | 8 - 4 | 1.01 | 11 - 10 | 1.05 |
| 3 - 2 | 1.20 | 8 - 5 | 1.01 | 11 - 11 | 1.05 |
| 3 - 3 | 1.19 | 8 - 6 | 1.01 | 12 - 0 | 1.06 |
| 3 - 4 | 1.18 | 8 - 7 | 1.01 | 12 - 1 | 1.06 |
| 3 - 5 | 1.17 | 8 - 8 | 1.01 | 12 - 2 | 1.06 |
| 3 - 6 | 1.16 | 8 - 9 | 1.01 | 12 - 3 | 1.06 |
| 3 - 7 | 1.15 | 8 - 10 | 1.01 | 12 - 4 | 1.06 |
| 3 - 8 | 1.14 | 8 - 11 | 1.01 | 12 - 5 | 1.06 |
| 3 - 9 | 1.13 | 9 - 0 | 1.01 | 12 - 6 | 1.07 |
| 3 - 10 | 1.12 | 9 - 1 | 1.01 | 12 - 7 | 1.07 |
| 3 - 11 | 1.11 | 9 - 2 | 1.01 | 12 - 8 | 1.07 |
| 4 - 0 | 1.10 | 9 - 3 | 1.01 | 12 - 9 | 1.07 |
| 4 - 1 | 1.09 | 9 - 4 | 1.01 | 12 - 10 | 1.07 |
| 4 - 2 | 1.09 | 9 - 5 | 1.01 | 12 - 11 | 1.07 |
| 4 - 3 | 1.08 | 9 - 6 | 1.02 | 13 - 0 | 1.08 |
| 4 - 4 | 1.08 | 9 - 7 | 1.02 | 13 - 1 | 1.08 |
| 4 - 5 | 1.07 | 9 - 8 | 1.02 | 13 - 2 | 1.08 |
| 4 - 6 | 1.07 | 9 - 9 | 1.02 | 13 - 3 | 1.08 |
| 4 - 7 | 1.06 | 9 - 10 | 1.02 | 13 - 4 | 1.08 |
| 4 - 8 | 1.06 | 9 - 11 | 1.02 | 13 - 5 | 1.08 |
| 4 - 9 | 1.05 | 10 - 0 | 1.02 | 13 - 6 | 1.09 |
| 4 - 10 | 1.05 | 10 - 1 | 1.02 | 13 - 7 | 1.09 |
| 4 - 11 | 1.04 | 10 - 2 | 1.02 | 13 - 8 | 1.09 |
| 5 - 0 | 1.04 | 10 - 3 | 1.02 | 13 - 9 | 1.09 |
| 5 - 1 | 1.04 | 10 - 4 | 1.02 | 13 - 10 | 1.09 |
| 5 - 2 | 1.03 | 10 - 5 | 1.02 | 13 - 11 | 1.09 |
| | | | | 14 - 0 | 1.10 |

Table 2. -New age-conversion factors for 305-day production records-
continued

GUERNSEY

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|----------|--------|---------|--------|
| 1 - 9 | 1.31 | 5 - 3 | 1.01 | 10 - 6 | 1.05 |
| 1 - 10 | 1.28 | 5 - 4 | 1.01 | 10 - 7 | 1.05 |
| 1 - 11 | 1.26 | 5 - 5 | 1.01 | 10 - 8 | 1.05 |
| 2 - 0 | 1.24 | 5 - 6 | 1.01 | 10 - 9 | 1.05 |
| 2 - 1 | 1.23 | 5 - 7 to | | 10 - 10 | 1.05 |
| 2 - 2 | 1.22 | 7 - 5 | 1.00 | 10 - 11 | 1.05 |
| 2 - 3 | 1.21 | 7 - 6 | 1.01 | 11 - 0 | 1.06 |
| 2 - 4 | 1.20 | 7 - 7 | 1.01 | 11 - 1 | 1.06 |
| 2 - 5 | 1.19 | 7 - 8 | 1.01 | 11 - 2 | 1.06 |
| 2 - 6 | 1.18 | 7 - 9 | 1.01 | 11 - 3 | 1.06 |
| 2 - 7 | 1.17 | 7 - 10 | 1.01 | 11 - 4 | 1.06 |
| 2 - 8 | 1.16 | 7 - 11 | 1.01 | 11 - 5 | 1.06 |
| 2 - 9 | 1.15 | 8 - 0 | 1.01 | 11 - 6 | 1.07 |
| 2 - 10 | 1.14 | 8 - 1 | 1.02 | 11 - 7 | 1.07 |
| 2 - 11 | 1.13 | 8 - 2 | 1.02 | 11 - 8 | 1.07 |
| 3 - 0 | 1.12 | 8 - 3 | 1.02 | 11 - 9 | 1.07 |
| 3 - 1 | 1.11 | 8 - 4 | 1.02 | 11 - 10 | 1.07 |
| 3 - 2 | 1.10 | 8 - 5 | 1.02 | 11 - 11 | 1.07 |
| 3 - 3 | 1.09 | 8 - 6 | 1.02 | 12 - 0 | 1.08 |
| 3 - 4 | 1.09 | 8 - 7 | 1.02 | 12 - 1 | 1.08 |
| 3 - 5 | 1.09 | 8 - 8 | 1.02 | 12 - 2 | 1.08 |
| 3 - 6 | 1.08 | 8 - 9 | 1.02 | 12 - 3 | 1.08 |
| 3 - 7 | 1.08 | 8 - 10 | 1.02 | 12 - 4 | 1.08 |
| 3 - 8 | 1.08 | 8 - 11 | 1.02 | 12 - 5 | 1.08 |
| 3 - 9 | 1.07 | 9 - 0 | 1.02 | 12 - 6 | 1.09 |
| 3 - 10 | 1.07 | 9 - 1 | 1.03 | 12 - 7 | 1.09 |
| 3 - 11 | 1.07 | 9 - 2 | 1.03 | 12 - 8 | 1.09 |
| 4 - 0 | 1.06 | 9 - 3 | 1.03 | 12 - 9 | 1.09 |
| 4 - 1 | 1.06 | 9 - 4 | 1.03 | 12 - 10 | 1.09 |
| 4 - 2 | 1.06 | 9 - 5 | 1.03 | 12 - 11 | 1.09 |
| 4 - 3 | 1.05 | 9 - 6 | 1.03 | 13 - 0 | 1.10 |
| 4 - 4 | 1.05 | 9 - 7 | 1.03 | 13 - 1 | 1.10 |
| 4 - 5 | 1.05 | 9 - 8 | 1.03 | 13 - 2 | 1.10 |
| 4 - 6 | 1.04 | 9 - 9 | 1.03 | 13 - 3 | 1.10 |
| 4 - 7 | 1.04 | 9 - 10 | 1.03 | 13 - 4 | 1.10 |
| 4 - 8 | 1.04 | 9 - 11 | 1.03 | 13 - 5 | 1.10 |
| 4 - 9 | 1.03 | 10 - 0 | 1.04 | 13 - 6 | 1.11 |
| 4 - 10 | 1.03 | 10 - 1 | 1.04 | 13 - 7 | 1.11 |
| 4 - 11 | 1.03 | 10 - 2 | 1.04 | 13 - 8 | 1.11 |
| 5 - 0 | 1.02 | 10 - 3 | 1.04 | 13 - 9 | 1.11 |
| 5 - 1 | 1.02 | 10 - 4 | 1.04 | 13 - 10 | 1.11 |
| 5 - 2 | 1.02 | 10 - 5 | 1.04 | 13 - 11 | 1.11 |
| | | | | 14 - 0 | 1.12 |

Table 2. -New age-conversion factors for 305-day production records-
continued

HOLSTEIN AND RED DANE

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|--------|--------|---------|--------|
| 1 - 9 | 1.37 | 5 - 0 | 1.02 | 10 - 6 | 1.05 |
| 1 - 10 | 1.35 | 5 - 1 | 1.02 | 10 - 7 | 1.05 |
| 1 - 11 | 1.33 | 5 - 2 | 1.02 | 10 - 8 | 1.05 |
| | | 5 - 3 | 1.02 | 10 - 9 | 1.06 |
| 2 - 0 | 1.31 | 5 - 4 | 1.02 | 10 - 10 | 1.06 |
| 2 - 1 | 1.30 | 5 - 5 | 1.02 | 10 - 11 | 1.06 |
| 2 - 2 | 1.29 | | | | |
| 2 - 3 | 1.28 | 5 - 6 | 1.02 | 11 - 0 | 1.06 |
| 2 - 4 | 1.26 | 5 - 7 | 1.01 | 11 - 1 | 1.06 |
| 2 - 5 | 1.25 | 5 - 8 | 1.01 | 11 - 2 | 1.06 |
| | | 5 - 9 | 1.01 | 11 - 3 | 1.07 |
| 2 - 6 | 1.24 | 5 - 10 | 1.01 | 11 - 4 | 1.07 |
| 2 - 7 | 1.23 | 5 - 11 | 1.01 | 11 - 5 | 1.07 |
| 2 - 8 | 1.22 | | | | |
| 2 - 9 | 1.21 | 6 - 0 | | 11 - 6 | 1.07 |
| 2 - 10 | 1.20 | to | | 11 - 7 | 1.08 |
| 2 - 11 | 1.19 | 8 - 5 | 1.00 | 11 - 8 | 1.08 |
| | | | | 11 - 9 | 1.08 |
| 3 - 0 | 1.18 | 8 - 6 | 1.01 | 11 - 10 | 1.08 |
| 3 - 1 | 1.17 | 8 - 7 | 1.01 | 11 - 11 | 1.09 |
| 3 - 2 | 1.16 | 8 - 8 | 1.01 | | |
| 3 - 3 | 1.15 | 8 - 9 | 1.02 | 12 - 0 | 1.09 |
| 3 - 4 | 1.14 | 8 - 10 | 1.02 | 12 - 1 | 1.09 |
| 3 - 5 | 1.13 | 8 - 11 | 1.02 | 12 - 2 | 1.09 |
| | | | | 12 - 3 | 1.10 |
| 3 - 6 | 1.12 | 9 - 0 | 1.02 | 12 - 4 | 1.10 |
| 3 - 7 | 1.12 | 9 - 1 | 1.02 | 12 - 5 | 1.10 |
| 3 - 8 | 1.11 | 9 - 2 | 1.02 | | |
| 3 - 9 | 1.10 | 9 - 3 | 1.03 | 12 - 6 | 1.10 |
| 3 - 10 | 1.10 | 9 - 4 | 1.03 | 12 - 7 | 1.11 |
| 3 - 11 | 1.09 | 9 - 5 | 1.03 | 12 - 8 | 1.11 |
| | | | | 12 - 9 | 1.11 |
| 4 - 0 | 1.08 | 9 - 6 | 1.03 | 12 - 10 | 1.11 |
| 4 - 1 | 1.07 | 9 - 7 | 1.03 | 12 - 11 | 1.12 |
| 4 - 2 | 1.06 | 9 - 8 | 1.03 | | |
| 4 - 3 | 1.05 | 9 - 9 | 1.04 | 13 - 0 | 1.12 |
| 4 - 4 | 1.05 | 9 - 10 | 1.04 | 13 - 1 | 1.12 |
| 4 - 5 | 1.04 | 9 - 11 | 1.04 | 13 - 2 | 1.12 |
| | | | | 13 - 3 | 1.13 |
| 4 - 6 | 1.04 | 10 - 0 | 1.04 | 13 - 4 | 1.13 |
| 4 - 7 | 1.03 | 10 - 1 | 1.04 | 13 - 5 | 1.13 |
| 4 - 8 | 1.03 | 10 - 2 | 1.04 | | |
| 4 - 9 | 1.03 | 10 - 3 | 1.05 | 13 - 6 | 1.13 |
| 4 - 10 | 1.03 | 10 - 4 | 1.05 | 13 - 7 | 1.14 |
| 4 - 11 | 1.03 | 10 - 5 | 1.05 | 13 - 8 | 1.14 |
| | | | | 13 - 9 | 1.14 |
| | | | | 13 - 10 | 1.14 |
| | | | | 13 - 11 | 1.14 |
| | | | | 14 - 0 | 1.15 |

Table 2. -New age-conversion factors for 305-day production records-
continued

JERSEY

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|----------|--------|---------|--------|
| 1 - 9 | 1.32 | 5 - 3 | 1.01 | 10 - 6 | 1.05 |
| 1 - 10 | 1.30 | 5 - 4 | 1.01 | 10 - 7 | 1.05 |
| 1 - 11 | 1.28 | 5 - 5 | 1.01 | 10 - 8 | 1.05 |
| 2 - 0 | 1.27 | 5 - 6 | 1.01 | 10 - 9 | 1.05 |
| 2 - 1 | 1.26 | 5 - 7 to | | 10 - 10 | 1.05 |
| 2 - 2 | 1.25 | 7 - 5 | 1.00 | 10 - 11 | 1.05 |
| 2 - 3 | 1.24 | 7 - 6 | 1.01 | 11 - 0 | 1.06 |
| 2 - 4 | 1.23 | 7 - 7 | 1.01 | 11 - 1 | 1.06 |
| 2 - 5 | 1.22 | 7 - 8 | 1.01 | 11 - 2 | 1.06 |
| 2 - 6 | 1.21 | 7 - 9 | 1.01 | 11 - 3 | 1.06 |
| 2 - 7 | 1.20 | 7 - 10 | 1.01 | 11 - 4 | 1.06 |
| 2 - 8 | 1.19 | 7 - 11 | 1.01 | 11 - 5 | 1.06 |
| 2 - 9 | 1.18 | 8 - 0 | 1.01 | 11 - 6 | 1.07 |
| 2 - 10 | 1.17 | 8 - 1 | 1.02 | 11 - 7 | 1.07 |
| 2 - 11 | 1.16 | 8 - 2 | 1.02 | 11 - 8 | 1.07 |
| 3 - 0 | 1.15 | 8 - 3 | 1.02 | 11 - 9 | 1.07 |
| 3 - 1 | 1.14 | 8 - 4 | 1.02 | 11 - 10 | 1.07 |
| 3 - 2 | 1.13 | 8 - 5 | 1.02 | 11 - 11 | 1.07 |
| 3 - 3 | 1.12 | 8 - 6 | 1.02 | 12 - 0 | 1.08 |
| 3 - 4 | 1.11 | 8 - 7 | 1.02 | 12 - 1 | 1.08 |
| 3 - 5 | 1.10 | 8 - 8 | 1.02 | 12 - 2 | 1.08 |
| 3 - 6 | 1.09 | 8 - 9 | 1.02 | 12 - 3 | 1.08 |
| 3 - 7 | 1.09 | 8 - 10 | 1.02 | 12 - 4 | 1.08 |
| 3 - 8 | 1.08 | 8 - 11 | 1.02 | 12 - 5 | 1.08 |
| 3 - 9 | 1.08 | 9 - 0 | 1.02 | 12 - 6 | 1.09 |
| 3 - 10 | 1.07 | 9 - 1 | 1.03 | 12 - 7 | 1.09 |
| 3 - 11 | 1.07 | 9 - 2 | 1.03 | 12 - 8 | 1.09 |
| 4 - 0 | 1.06 | 9 - 3 | 1.03 | 12 - 9 | 1.09 |
| 4 - 1 | 1.06 | 9 - 4 | 1.03 | 12 - 10 | 1.09 |
| 4 - 2 | 1.05 | 9 - 5 | 1.03 | 12 - 11 | 1.09 |
| 4 - 3 | 1.05 | 9 - 6 | 1.03 | 13 - 0 | 1.10 |
| 4 - 4 | 1.04 | 9 - 7 | 1.03 | 13 - 1 | 1.10 |
| 4 - 5 | 1.04 | 9 - 8 | 1.03 | 13 - 2 | 1.10 |
| 4 - 6 | 1.03 | 9 - 9 | 1.03 | 13 - 3 | 1.10 |
| 4 - 7 | 1.03 | 9 - 10 | 1.03 | 13 - 4 | 1.10 |
| 4 - 8 | 1.03 | 9 - 11 | 1.03 | 13 - 5 | 1.10 |
| 4 - 9 | 1.03 | 10 - 0 | 1.04 | 13 - 6 | 1.11 |
| 4 - 10 | 1.02 | 10 - 1 | 1.04 | 13 - 7 | 1.11 |
| 4 - 11 | 1.02 | 10 - 2 | 1.04 | 13 - 8 | 1.11 |
| 5 - 0 | 1.02 | 10 - 3 | 1.04 | 13 - 9 | 1.11 |
| 5 - 1 | 1.02 | 10 - 4 | 1.04 | 13 - 10 | 1.11 |
| 5 - 2 | 1.01 | 10 - 5 | 1.04 | 13 - 11 | 1.11 |
| | | | | 14 - 0 | 1.12 |

Table 2. -New age-conversion factors for 305-day production records-
continued

MILKING SHORTHORN AND RED POLL

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|--------|--------|---------|--------|
| 1 - 9 | 1.47 | 5 - 1 | 1.07 | 9 - 8 | 1.03 |
| 1 - 10 | 1.46 | 5 - 2 | 1.06 | 9 - 9 | 1.03 |
| 1 - 11 | 1.44 | 5 - 3 | 1.06 | 9 - 10 | 1.03 |
| 2 - 0 | 1.42 | 5 - 4 | 1.05 | 9 - 11 | 1.04 |
| 2 - 1 | 1.39 | 5 - 5 | 1.05 | 10 - 0 | 1.04 |
| 2 - 2 | 1.37 | 5 - 6 | 1.04 | 10 - 1 | 1.04 |
| 2 - 3 | 1.35 | 5 - 7 | 1.04 | 10 - 2 | 1.04 |
| 2 - 4 | 1.33 | 5 - 8 | 1.03 | 10 - 3 | 1.04 |
| 2 - 5 | 1.31 | 5 - 9 | 1.03 | 10 - 4 | 1.04 |
| 2 - 6 | 1.30 | 5 - 10 | 1.02 | 10 - 5 | 1.04 |
| 2 - 7 | 1.29 | 5 - 11 | 1.02 | 10 - 6 | 1.05 |
| 2 - 8 | 1.28 | 6 - 0 | 1.01 | 10 - 7 | 1.05 |
| 2 - 9 | 1.27 | 6 - 1 | 1.01 | 10 - 8 | 1.05 |
| 2 - 10 | 1.26 | 6 - 2 | 1.01 | 10 - 9 | 1.05 |
| 2 - 11 | 1.25 | 6 - 3 | 1.01 | 10 - 10 | 1.05 |
| 3 - 0 | 1.24 | 6 - 4 | | 10 - 11 | 1.05 |
| 3 - 1 | 1.23 | to | | 11 - 0 | 1.06 |
| 3 - 2 | 1.22 | 7 - 9 | 1.00 | 11 - 1 | 1.06 |
| 3 - 3 | 1.21 | 7 - 10 | 1.01 | 11 - 2 | 1.06 |
| 3 - 4 | 1.20 | 7 - 11 | 1.01 | 11 - 3 | 1.06 |
| 3 - 5 | 1.19 | 8 - 0 | 1.01 | 11 - 4 | 1.06 |
| 3 - 6 | 1.18 | 8 - 1 | 1.01 | 11 - 5 | 1.06 |
| 3 - 7 | 1.17 | 8 - 2 | 1.01 | 11 - 6 | 1.07 |
| 3 - 8 | 1.16 | 8 - 3 | 1.01 | 11 - 7 | 1.07 |
| 3 - 9 | 1.15 | 8 - 4 | 1.01 | 11 - 8 | 1.07 |
| 3 - 10 | 1.14 | 8 - 5 | 1.01 | 11 - 9 | 1.07 |
| 3 - 11 | 1.14 | 8 - 6 | 1.01 | 11 - 10 | 1.07 |
| 4 - 0 | 1.13 | 8 - 7 | 1.02 | 11 - 11 | 1.07 |
| 4 - 1 | 1.13 | 8 - 8 | 1.02 | 12 - 0 | 1.08 |
| 4 - 2 | 1.12 | 8 - 9 | 1.02 | 12 - 1 | 1.08 |
| 4 - 3 | 1.12 | 8 - 10 | 1.02 | 12 - 2 | 1.08 |
| 4 - 4 | 1.11 | 8 - 11 | 1.02 | 12 - 3 | 1.08 |
| 4 - 5 | 1.11 | 9 - 0 | 1.02 | 12 - 4 | 1.08 |
| 4 - 6 | 1.10 | 9 - 1 | 1.02 | 12 - 5 | 1.08 |
| 4 - 7 | 1.10 | 9 - 2 | 1.02 | 12 - 6 | 1.09 |
| 4 - 8 | 1.09 | 9 - 3 | 1.03 | 12 - 7 | 1.09 |
| 4 - 9 | 1.09 | 9 - 4 | 1.03 | 12 - 8 | 1.09 |
| 4 - 10 | 1.08 | 9 - 5 | 1.03 | 12 - 9 | 1.09 |
| 4 - 11 | 1.08 | 9 - 6 | 1.03 | 12 - 10 | 1.09 |
| 5 - 0 | 1.07 | 9 - 7 | 1.03 | 12 - 11 | 1.09 |
| | | | | 13 - 0 | 1.10 |

Table 2. -New age-conversion factors for 305-day production records-
continued

MIXED BREED

| Age | Factor | Age | Factor | Age | Factor |
|--------|--------|--------|--------|---------|--------|
| 1 - 9 | 1.37 | 5 - 3 | 1.02 | 10 - 6 | 1.05 |
| 1 - 10 | 1.35 | 5 - 4 | 1.02 | 10 - 7 | 1.05 |
| 1 - 11 | 1.33 | 5 - 5 | 1.02 | 10 - 8 | 1.05 |
| 2 - 0 | 1.31 | 5 - 6 | 1.02 | 10 - 9 | 1.05 |
| 2 - 1 | 1.30 | 5 - 7 | 1.01 | 10 - 10 | 1.05 |
| 2 - 2 | 1.29 | 5 - 8 | 1.01 | 10 - 11 | 1.05 |
| 2 - 3 | 1.28 | 5 - 9 | 1.01 | 11 - 0 | 1.06 |
| 2 - 4 | 1.26 | 5 - 10 | 1.01 | 11 - 1 | 1.06 |
| 2 - 5 | 1.25 | 5 - 11 | 1.01 | 11 - 2 | 1.06 |
| 2 - 6 | 1.24 | 6 - 0 | | 11 - 3 | 1.06 |
| 2 - 7 | 1.23 | to | | 11 - 4 | 1.06 |
| 2 - 8 | 1.22 | 7 - 11 | 1.00 | 11 - 5 | 1.06 |
| 2 - 9 | 1.21 | 8 - 0 | 1.00 | 11 - 6 | 1.07 |
| 2 - 10 | 1.20 | 8 - 1 | 1.01 | 11 - 7 | 1.07 |
| 2 - 11 | 1.19 | 8 - 2 | 1.01 | 11 - 8 | 1.07 |
| 3 - 0 | 1.18 | 8 - 3 | 1.01 | 11 - 9 | 1.07 |
| 3 - 1 | 1.17 | 8 - 4 | 1.01 | 11 - 10 | 1.07 |
| 3 - 2 | 1.16 | 8 - 5 | 1.01 | 11 - 11 | 1.07 |
| 3 - 3 | 1.15 | 8 - 6 | 1.01 | 12 - 0 | 1.08 |
| 3 - 4 | 1.14 | 8 - 7 | 1.01 | 12 - 1 | 1.08 |
| 3 - 5 | 1.13 | 8 - 8 | 1.01 | 12 - 2 | 1.08 |
| 3 - 6 | 1.12 | 8 - 9 | 1.02 | 12 - 3 | 1.08 |
| 3 - 7 | 1.12 | 8 - 10 | 1.02 | 12 - 4 | 1.08 |
| 3 - 8 | 1.11 | 8 - 11 | 1.02 | 12 - 5 | 1.08 |
| 3 - 9 | 1.10 | 9 - 0 | 1.02 | 12 - 6 | 1.09 |
| 3 - 10 | 1.10 | 9 - 1 | 1.02 | 12 - 7 | 1.09 |
| 3 - 11 | 1.09 | 9 - 2 | 1.02 | 12 - 8 | 1.09 |
| 4 - 0 | 1.08 | 9 - 3 | 1.02 | 12 - 9 | 1.09 |
| 4 - 1 | 1.07 | 9 - 4 | 1.02 | 12 - 10 | 1.09 |
| 4 - 2 | 1.06 | 9 - 5 | 1.03 | 12 - 11 | 1.09 |
| 4 - 3 | 1.05 | 9 - 6 | 1.03 | 13 - 0 | 1.10 |
| 4 - 4 | 1.05 | 9 - 7 | 1.03 | 13 - 1 | 1.10 |
| 4 - 5 | 1.04 | 9 - 8 | 1.03 | 13 - 2 | 1.10 |
| 4 - 6 | 1.04 | 9 - 9 | 1.03 | 13 - 3 | 1.10 |
| 4 - 7 | 1.03 | 9 - 10 | 1.03 | 13 - 4 | 1.10 |
| 4 - 8 | 1.03 | 9 - 11 | 1.03 | 13 - 5 | 1.10 |
| 4 - 9 | 1.03 | 10 - 0 | 1.04 | 13 - 6 | 1.11 |
| 4 - 10 | 1.03 | 10 - 1 | 1.04 | 13 - 7 | 1.11 |
| 4 - 11 | 1.03 | 10 - 2 | 1.04 | 13 - 8 | 1.11 |
| 5 - 0 | 1.02 | 10 - 3 | 1.04 | 13 - 9 | 1.11 |
| 5 - 1 | 1.02 | 10 - 4 | 1.04 | 13 - 10 | 1.11 |
| 5 - 2 | 1.02 | 10 - 5 | 1.04 | 13 - 11 | 1.11 |
| | | | | 14 - 0 | 1.12 |

Reducing Records to a Twice-a-day Milking Basis

The production records of cows milked more than twice a day are adjusted to a twice-a-day milking basis after the actual records have been converted to a mature-equivalent basis. All records made by cows milked more than twice a day during all or part of the 305-day lactation period are reduced to a twice-a-day milking basis by multiplying the mature-equivalent record by the appropriate factor in table 3, page 13.

For example, suppose a Jersey cow freshened at 4 years 6 months of age and that she was milked 3 times a day for 80 days of her 305-day lactation period. Her record is standardized as follows: (1) Her actual production record is multiplied by the factor 1.03 (table 2, page 9) to convert it to a mature-equivalent basis. (2) Her mature-equivalent record is reduced to a twice-a-day milking basis by multiplying by the factor 0.96 (table 3, page 13, Column headed factor for 3 times-a-day milking, 4 years of age and over, Line 76 to 85 days). The result is her standardized record, that is, her 305-day age-corrected record on a twice-a-day milking basis.

Suppose a Brown Swiss cow freshened at 3 years 6 months of age and was milked 4 times a day for 50 days of her lactation period. Her record is standardized as follows: (1) Her record is converted to a mature-equivalent basis by using the age-conversion factor 1.16 (table 2, page 6). (2) Her mature-equivalent record is reduced to a twice-a-day milking basis by multiplying by the factor 0.95 (table 3, page 13, Column headed factor for 4 times-a-day milking, 3 to 4 years of age, Line 46 to 55 days). The result is her standardized record.

To standardize the record of a cow that was milked 2, 3, and 4 times a day for different periods while she was making her record, the procedure is somewhat more involved.

The record is first converted to a mature-equivalent basis by using the appropriate age-conversion factor in table 2.

Then her mature-equivalent record is reduced to a twice-a-day milking basis as follows: The number of days she was milked 3 times a day is converted to a 4-times-a-day basis by multiplying by the factor 0.6. (It is assumed that she would have produced as much milk on 4 milkings a day in 0.6 as many days as she did on 3 milkings a day.) The figure obtained is added to the number of days she was actually milked 4 times a day to obtain a 4-times-a-day milking figure. Then her mature-equivalent record is reduced to a twice-a-day milking basis in the usual way.

For example, suppose a Holstein cow freshened at 4 years 5 months of age and was milked 4 times a day for 35 days, 3 times a day for 100

Table 3.-Factors for reducing 305-day, age-corrected records to a twice-a-day milking basis

| Number of days milked | Factor for 3-times-a-day milking | | | Factor for 4-times-a-day milking | | |
|--------------------------|-------------------------------------|---------------------------|-------------------------------|-------------------------------------|---------------------------|-------------------------------|
| | 2 to 3 years of age | 3 to 4 years of age | 4 years of age and over | 2 to 3 years of age | 3 to 4 years of age | 4 years of age and over |
| 5 to 15 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 0.99 |
| 16 to 25 | .98 | .99 | .99 | .97 | .98 | .98 |
| 26 to 35 | .98 | .98 | .98 | .96 | .97 | .97 |
| 36 to 45 | .97 | .98 | .98 | .95 | .96 | .96 |
| 46 to 55 | .97 | .97 | .97 | .94 | .95 | .96 |
| 56 to 65 | .96 | .97 | .97 | .93 | .94 | .95 |
| 66 to 75 | .95 | .96 | .96 | .92 | .93 | .94 |
| 76 to 85 | .95 | .95 | .96 | .91 | .92 | .93 |
| 86 to 95 | .94 | .95 | .96 | .90 | .91 | .93 |
| 96 to 105 | .94 | .94 | .95 | .89 | .91 | .92 |
| 106 to 115 | .93 | .94 | .95 | .88 | .90 | .91 |
| 116 to 125 | .92 | .93 | .94 | .87 | .89 | .90 |
| 126 to 135 | .92 | .93 | .94 | .87 | .88 | .90 |
| 136 to 145 | .91 | .93 | .93 | .86 | .88 | .89 |
| 146 to 155 | .91 | .92 | .93 | .85 | .87 | .88 |
| 156 to 165 | .90 | .92 | .93 | .84 | .86 | .88 |
| 166 to 175 | .90 | .91 | .92 | .83 | .85 | .87 |
| 176 to 185 | .89 | .91 | .92 | .82 | .85 | .86 |
| 186 to 195 | .89 | .90 | .91 | .82 | .84 | .86 |
| 196 to 205 | .88 | .90 | .91 | .81 | .83 | .85 |
| 206 to 215 | .88 | .89 | .90 | .80 | .83 | .85 |
| 216 to 225 | .87 | .89 | .90 | .79 | .82 | .84 |
| 226 to 235 | .87 | .88 | .90 | .79 | .81 | .83 |
| 236 to 245 | .86 | .88 | .89 | .78 | .81 | .83 |
| 246 to 255 | .86 | .88 | .89 | .77 | .80 | .82 |
| 256 to 265 | .85 | .87 | .88 | .77 | .79 | .82 |
| 266 to 275 | .85 | .87 | .88 | .76 | .79 | .81 |
| 276 to 285 | .84 | .86 | .88 | .75 | .78 | .80 |
| 286 to 295 | .84 | .86 | .87 | .75 | .78 | .80 |
| 296 to 305 | .83 | .85 | .87 | .74 | .77 | .79 |

days, and twice a day for the balance of the 305-day lactation period. Her record is first converted to a mature-equivalent basis by using the age-conversion factor 1.04 (table 2, page 8). Then her mature-equivalent record is reduced to a twice-a-day milking basis as follows: (1) The number of days she was milked 3 times a day (100) is multiplied by 0.6 to convert it to a 4-times-a-day basis, or 60 days. This figure (60) is added to the number of days she was actually milked 4 times a day to obtain the total 4-times-a-day figure (60 + 35), or 95 days. Her mature-equivalent record is then reduced to a twice-a-day milking basis by multiplying by the factor 0.93 (table 3, page 13, Column headed factor for 4 times-a-day milking, 4 years of age and over, Line 86 to 95 days). The result is her standardized record.

